

REMARKS

By the above amendment, Applicants cancelled previously submitted claims 2-18 and replaced them with new claims 19-36 to define the invention more particularly and distinctly so as to overcome the technical rejections and define the invention over the prior art. The above new claims are submitted to be patentable over the art of record for the following reasons:

Claim Rejections – 35 USC § 102

The rejection of claims 2, 3, 5-11, 14-16 and 18 under 35 U.S.C. §102(b), as being anticipated by Hockman Re 30,027 is respectfully traversed.

Independent claim 18 has been rewritten as new claim 19 to narrow its scope as well as more particularly point out and distinctly claim the subject matter of the invention in a patentable manner.

Particularly, new independent claim 19 recites reflective surfaced reflecting and directing the incident radiant energy **by means of a single reflection** through spaces between adjacent pairs of “said rear longitudinal ends”. The same applies to dependent claims 20-36.

In claim 2, as now applicable to dependent claim 27, the term “all” has been added to explicitly recite the limitation positioning all reflective surfaces so that they reflect the incident rays coming from the light source at angles between 45 and 90 degrees, as pointed out by the Examiner.

The last O.A. stated (p. 2) regarding claims 18 that Hockman shows in Fig. 5 an apparatus for collecting radiation including an array of spaced apart, concave reflectors (16) with rear ends thereof being inclined toward each other, wherein energy which impinges upon the reflectors converged through spaces between adjacent reflector rear ends.

Applicants respectfully submit that new independent claim 19 distinguishes over Hockman under Section 102 because Hockman does not teach the limitation of a **single reflection** on “elongated reflective surfaces” having “generally concave transversal profiles” and being operable to reflect the incident radiant energy into a **plurality of convergent beams** and direct “said plurality of said convergent beams” to a **plurality of converging directions** through spaces between adjacent pairs of “said rear longitudinal ends”.

The Examiner has argued (p. 4) that multiple beams shown in Hockman fig. 5 clearly converge on the energy receiving means (20) and that there are multiple beams incident or converging upon the receiving means (20) which come from the concave reflectors.

Applicants submit that Hockman shows a plurality of known reflectors and teaches how to collect incident solar radiation using a combination of concave and convex reflective surfaces. Particularly, the reflectors (see Figs. 4 and 5 in Hockman) are generally positioned so that the adjacent pairs of concave and convex surfaces act as light guides using multiple reflections at all incident angles. As a matter of optics, an incident beam, once reflected from a convex surface at any incidence angle, becomes divergent. Furthermore, any beam undergoing multiple reflections from a concave surface and an adjacent concave surface will generally also become divergent.

Applicants position **at least a substantial part** of concave surfaces in such a way that the incident energy is reflected only once before it is directed toward the receiver through spaces between adjacent surfaces. It will also be appreciated that, as claim 19 clearly recites, these concave surfaces are operable to form multiple **convergent** beams each being directed to a plurality of **converging** directions. Thus, Hockman does not teach the limitation and useful feature of the present invention of using only convergent fluxes to illuminate the energy receiver using a single reflection and thus improving the energy collection efficiency.

The last O.A. stated (p. 4) that the present claims do not preclude plural reflections from the same reflector. Applicants respectfully submit that new claim 19 clearly recites directing “a plurality of convergent beams” **by means of a single reflection** through spaces between adjacent pairs of the rear longitudinal surface ends. Thus, independent claim 19 and dependent claims 20-36 preclude any multiple reflections from the same reflector.

The last O.A. also stated that the present claims do not preclude the addition of other elements in the device of Hockman, such as the convex reflector (22). Applicants argue that, for the reasons stated above, the present claims preclude multiple reflections and thus preclude the addition of the convex reflector. It should also be noted that a convex reflector, such as that shown in Hockman, generally forms a divergent beam. Therefore, by adding a convex reflector to intercept incident rays, Hockman teaches away from using a single reflection for concentrating the incident energy. Furthermore,

Hockman does not teach positioning the convex reflector to direct the incident flux to a plurality of converging directions through spaces between longitudinal ends of adjacent reflective surfaces.

When Hockman positions his curved reflective surfaces, he considers multiple reflections from the same reflector (16), reflective surfaces of adjacent reflectors (one surface being concave and the other being convex) and a convex radiation reflector (22) mounted below the heliocoidal fluid-bearing tube (20) for most of the incident rays and for all incident angles (see Fig. 5). Therefore, he cannot avoid the loss of incident energy inherent to multiple reflections. He does not consider nor is he aware of positioning at least a substantial part of concave reflective surfaces to direct the incident radiation to a common focus through spaces between adjacent longitudinal surface ends by means of a single reflection.

Thus applicants submit that new independent claim 19 recites novel physical features, which, in combination, create a new system for collecting and converting radiant energy and hence is patentable under § 102 over Hockman.

Dependent claims 20-36 incorporate all subject matter of claim 19 and add additional matter which, in combination with novel features of claim 19, makes them a fortiori and independently patentable over Hockman.

New claim 20 adds an elongated energy receiver disposed in energy receiving relation to each of reflective surfaces so that the convergent energy beams reflected from each pair of adjacent reflective surfaces at least partially superimpose on one another on the receiver. Hockman does not teach this limitation, since pairs of adjacent reflectors in his device do not produce convergent energy beams superimposing on one another.

New claim 21 further adds that “energy receiving means is positioned according to a relation: $\beta < 90^\circ$ ”. This, in combination with the limitation of a single reflection of claim 19, is also foreign to Hockman.

New claims 22 through 24 additionally different receiver types to the novel features of claims 19 and 20.

New claim 25 further recites a receiver being mechanically separated from the plurality of reflective surfaces. Hockman shows his reflectors and helicoidal tube longitudinally mounted within an outer enclosure assembly and thus precludes any mechanical separation of reflectors from the receiver.

New claim 26 adds one or more planar reflective surfaces replacing one or more curved reflective surfaces and having the same basic arrangement. While Hockman shows multiple vertical planar reflectors positioned perpendicular to the plurality of longitudinally aligned curved reflective surfaces, he does not show any elongated planar reflectors having the same basic orientation as the longitudinally aligned curved reflective surfaces.

New claim 27 adds a limitation of all incident angles being more than 45° and less than 90° . This limitation is not taught in Hockman, since, as can be seen from his Fig. 5, multiple rays are impinging on reflector surfaces at angles being less than 45° .

New claims 28 and 29 recite various dispositions of reflective surfaces relatively to the others, including their rotation and translation. Accordingly, Hockman teaches away from these limitations, since his longitudinally aligned curved reflectors are mounted on a rigid frame and interconnected by multiple vertical flat reflectors which prevent any other dispositions of the reflectors.

New claim 30 recites positioning the reflective surfaces so that the front end of an inner reflective surface and the rear end of an adjacent outer reflective surface are aligned relatively to each other with respect to the incident flux and the rear end of the inner reflective surface is disposed out of the path of energy rays reflected from the front end of the outer surface. Hockman, as seen in his Fig. 4 and Fig. 5, shows curved reflectors which shadowing a substantial part of adjacent reflectors. On the other hand, the innermost reflectors are spaced to far apart so that they do not intercept a substantial portion of incident energy. Thus, Hockman teaches away from positioning the reflective surfaces in a manner so as to minimize screening and shadowing on adjacent surfaces.

New claims 31-35 add further limitations to the novel and unobvious features of claim 19 and recite different transversal profiles for reflective surfaces. While each of such profiles is well known in the art, none of the known prior art methods and devices has incorporated, in combination, the features claims 19 and 31-35.

Lastly, claim 36 further adds at least one axle support for tracking the movement of the source of radiant energy. Accordingly, this feature, in combination with novel features of claim 19, is patentable over Hockman and any other prior art reference.

Thus, for the above reasons, applicants request reconsideration of the rejection of independent claim 18 and dependent claims 2,3,5-11 and 14-16, as now applicable to new independent claim 19 and dependent claims 27, 30, 31-35, 21, 24, 25, and 28 under 35 U.S.C. 102.

Claim Rejections – 35 USC § 103

The rejection of claims 4 and 17 as being unpatentable under 35 U.S.C. §103(a) over Hockman and claims 12 and 13 as being unpatentable under 35 U.S.C. §103(a) over Hockman in view of Cornwall et al of record 5,180,441 is respectfully traversed.

As stated above, claim 18 has been rewritten as a new claim 19 to define patentably over Hockman. Also applicants submit that the novel physical features of claim 19 are also unobvious and hence patentable under §103 since they produce new and unexpected results over Hockman and Cornwall. Dependent claims 4, 17, 12 and 13 have been rewritten as new claims 26, 36, 22 and 23 which incorporate all the subject matter of claim 19 and add additional matters which, in combination with novel features of claim 19, makes them a fortiori and independently patentable over Hockman and Cornwall, or any combination thereof.

Particularly, new claim 26 adds one or more elongated planar reflective surfaces to the apparatus of new claim 19. While planar reflectors are well known in the art, no other references, including Hockman, show them in combination with “reflective surfaces” having generally “concave transversal profiles” and operating in the most efficient manner to collect and convert radiant energy.

Claim 36 further adds an “axle support means”. Similarly, while tracking devices are widely used in connection with energy collectors, this subject matter in combinations with novel features of new claim 19 creates new and unobvious results, particularly, improved energy concentration and collection.

Claim 22 and dependent claim 23 further add "at least one photovoltaic cell" to the apparatus of new claim 19. Accordingly, with new claim 19 being unobvious and patentable over Hockman, these dependent claims are independently patentable under §103(a) over Hockman in view of Cornwell.

Conclusion

In view of all the foregoing reasons, applicants respectfully submit that the claims are now in the proper form and this application is in condition for allowance, and such allowance is therefore requested.

Respectfully submitted,



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